

Article

The Rise and Fall of BritainsDNA: A Tale of Misleading Claims, Media Manipulation and Threats to Academic Freedom

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Abstract: Direct-to-consumer genetic ancestry testing is a new and growing industry that has gained widespread media coverage and public interest. Its scientific base is in the fields of population and evolutionary genetics and it has benefitted considerably from recent advances in rapid and cost-effective DNA typing technologies. There is a considerable body of scientific literature on the use of genetic data to make inferences about human population history, although publications on inferring the ancestry of specific individuals are rarer. Population geneticists have questioned the scientific validity of some population history inference approaches, particularly those of a more interpretative nature. These controversies have spilled over into commercial genetic ancestry testing, with some companies making sensational claims about their products. One such company—BritainsDNA—made a number of dubious claims both directly to its customers and in the media. Here we outline our scientific concerns, document the exchanges between us, BritainsDNA and the BBC, and discuss the issues raised about media promotion of commercial enterprises, academic freedom of expression, science and pseudoscience and the genetic ancestry testing industry. We provide a detailed account of this case as a resource for historians and sociologists of science, and to shape public understanding, media reporting and scientific scrutiny of the commercial use of population and evolutionary genetics.

Keywords: BBC; BritainsDNA; genetic genealogy; pseudoscience; genetic ancestry testing; academic freedom; science journalism; media studies

1. Introduction

Scientists have an important role to play as public communicators of science (Peters 2013; 2014). Public relations departments in universities encourage and facilitate media contact based on the belief that a media presence will give the institution visibility and will help to attract students (Peters 2013). Further, in an increasingly competitive market, universities are turning to new ways to raise money (Hale and Viña 2016) and scientists are under pressure to deliver commercial benefits from their research (Langley and Parkinson 2009). Some science-related companies are commercial spin-offs from universities and many academics take on consultancy roles in the private sector. Media-savvy companies try to attract free media coverage for their commercial products under the guise of public-interest science stories, which saves on the cost of advertising and gives an apparently independent endorsement of the product. There is great public interest in science but few journalists

are scientists or have any scientific training, which can result in sensationalised or unbalanced reporting (Science and Technology Committee, House of Commons 2017; Kennedy and Overholser 2010).

While most scientists take a broadly positive view of media exposure of their science and their host institutions typically encourage science-media interactions (Peters et al. 2008), tensions can arise between scientists and companies over the scientific basis of claims in the media that appear to the general public to be scientific but that are in effect little more than disguised marketing. Sometimes disagreements arise between independent scientists and scientists working for a company due to this apparent conflict of interest. Exaggerated claims, or claims with little scientific merit, can be lucrative in terms of business promotion but independent scientists may be concerned that they devalue the relevant scientific fields and create a misleading impression of the state of the science. Moreover, there appears to be little support provided by universities to individual scientists challenging questionable claims in the media.

Fear of legal action is also likely to be a factor in discouraging scientists from speaking out. The science writer Simon Singh was sued by the British Chiropractic Association (BCA) for comments made about chiropractors in an article in *The Guardian* (Cressey 2010). The legal case lasted for two years and the legal bills came to an estimated £400,000 (Singh 2010). The BCA were ultimately responsible for their own legal costs and the vast majority of Singh's legal costs but Singh lost a large amount of money in unrecovered legal costs (Singh 2010; Singh 2011). *The Guardian* newspaper was sued by Matthias Rath, a promoter of vitamin supplements for AIDS, over three critical articles written by the science writer and medical doctor Ben Goldacre (Boseley 2008). Rath eventually dropped the case but it cost the newspaper £500,000 in legal fees (Goldacre 2008). Although Rath was ordered by the high court to pay the initial costs, the newspaper lost £175,000 in unrecovered legal fees (Singh 2011). These high-profile cases were instrumental in calls for reform of the libel law in England and Wales (Nature editorial 2012). A new Defamation Act came into force on 1st January 2014 (BBC News 2013) but concerns still remain over the costs of litigation (Cressey 2013).

Direct-to-consumer genetic ancestry testing exemplifies many of the issues raised above and, in this article, we relate a case study of a company with strong media connections that was able to achieve substantial favourable coverage in newspapers, radio and television. The story is told by the group of concerned scientists and a genealogist (the authors) whose challenge to some of the company's claims was met with legal threats. We begin by first providing a guide to the science that underpins genetic ancestry testing before addressing the particular case of the BritainsDNA company. The rest of the paper focuses on our interactions with BritainsDNA, the role of the universities and the media in this case and our efforts to counter bad science.

2. Genetic Ancestry Testing

Direct-to-consumer genetic ancestry testing can provide customers with information that falls into two broad categories: (1) genetic genealogy, where relatedness among individuals can be tested on a timescale that supports traditional genealogical research; (2) deep ancestry, where more broad-scale population affinities and origins are inferred. This article is mostly concerned with claims about deep ancestry.

2.1. Ancestry Inference

Geographic patterns of genetic variation in human populations are shaped by a number of evolutionary processes, including natural selection, demographic history (migrations, expansions into new regions, population mixing and population size changes), genetic drift (the random changes in the frequencies of genetic variants through time), linkage (the tendency of genetic variants located near each other on the same chromosome to be inherited together) and mutation. Since we have a body of theory explaining how genetic drift, linkage and mutation operate and since over the timescale of human evolution we expect that most regions of the genome have not been subject to substantial natural selection, it follows that patterns of human genetic variation contain information about our

demographic history. These principles are the foundations of population history inference, regardless of whether we are interested in the history of whole populations, or the ancestries of individuals. However, before considering the various approaches used to infer population history and individual ancestry, it is important to note some facts that can seem counterintuitive.

Firstly, an individual's DNA is inherited from recent ancestors in large random chunks, so the contribution of DNA from any particular ancestor can be nil after just a handful of generations (Speed and Balding 2015). Indeed, there is a very high probability that we have not inherited DNA from any specific ancestor more than ten generations in the past. Therefore, each of us has inherited no DNA from the majority of our ancestors who lived just a few hundred years ago. Secondly, we all share common ancestors remarkably recently; it has been estimated that only three to five thousand years ago somebody lived who is the ancestor of every human alive today (Rohde et al. 2004). Furthermore, just a few thousand years earlier we all share exactly the same set of ancestors. These common ancestry dates become considerably more recent for people who are less distant, such as those on the same continent. Thirdly, because there is randomness in the genetic variants we inherit from our parents, many very different population histories or ancestries can give rise to the same patterns of genetic variation in a population or individual. The flip-side of this is that the same population history or ancestry can give rise to a broad range of very different genetic patterns in populations or an individual. This results in ancestral information loss that fundamentally limits what we can conclude about our overall ancestry from genetic data.

For the above and other reasons, inferring ancestry can be challenging. However, the human genome contains much information on population histories and ancestries; the main issue is how do we interpret that information in a scientifically robust manner? In this article, we will limit ourselves for the most part to discussion of two parts of our genomes that—until recently—were the main targets of genetic ancestry testing companies: the maternally inherited mitochondrial DNA (mtDNA) and the paternally inherited Y-chromosome (Y-chr) (Bolnick et al. 2007; Royal et al. 2010; Shriver and Kittles 2004). For mtDNA, both academic researchers and genetic testing companies will either read contiguous DNA sequences or type specific DNA sites, known as single nucleotide polymorphisms (SNPs), that are known to vary in human populations (Kivisild 2015). For the Y-chr, SNPs and/or short tandem repeats (STRs) are usually typed (Calafell and Larmuseau 2017; Jobling and Tyler-Smith 2017). Population variation in SNPs is usually the result of one mutation event, whereas variation in STRs is typically the result of many mutation events. These data types can be used to estimate the shape of the phylogenetic tree, or genealogy, relating different mtDNA or Y-chr types (known as haplotypes) to one another and to estimate when those haplotypes shared common ancestors (Van Oven 2015; Van Oven and Kayser 2009; Van Oven et al. 2014). A group of similar haplotypes that share a relatively recent common ancestor is often referred to as a haplogroup (Y Chromosome Consortium 2002). However, it should be noted that there is no natural or consistent level at which haplotypes are assigned to haplogroups.

While the mtDNA or Y-chr represent only a tiny fraction of both our genomes and our ancestries, their simple inheritance patterns can make them appealing for ancestral inference. They can, for example, complement traditional genealogical and surname research, which is often concerned with the single all-male line of ancestry. But, as a tool for understanding deeper ancestry and origins, that simplicity of inheritance is traded off against information content; we have inherited our mtDNA (or Y chr) from a single ancestor in every generation, which is a rapidly diminishing proportion of our ancestors as we look further back in time. Often described as representing our 'motherline' and 'fatherline' through time, the single ancestor that each includes in every generation is no more important for inherited characteristics than any of the many other ancestors in each generation. Further, despite the claims made in many published studies and by many genetic ancestry testing companies, it is usually not possible to accurately estimate from modern DNA alone the geographical source of a particular mtDNA or Y chr lineage, or where it moved to in the past (Balloux 2010; Chikhi 2009; Eriksson et al. 2012). This limitation can be better understood by considering the three main population

history inference approaches (Gerbault et al. 2014; Thomas et al. 2013) that have dominated the scientific literature over the last 40 years: (1) descriptive statistics; (2) model-based inference; (3) interpretative phylogeographic analysis.

Descriptive statistics are numerical summaries or graphical representations of genetic data, often in relation to their geographical distributions. In many cases, population genetic theory has shown that under very simple scenarios certain descriptive patterns can act as proxies for the processes we might find interesting, such as past migration or population growth. Researchers may then interpret these descriptive patterns as evidence for some migration event (Cavalli-Sforza et al. 1994) or population expansion (Rogers and Harpending 1992). Some of the pioneering work in the 1960s and 70s on inferring human population history from genetic data—led by Cavalli-Sforza and colleagues—followed this approach. They took blood group frequency data from various populations and used principal components analysis to find the major geographic clines in genetic variant frequencies. They interpreted these clines as signatures of major migratory episodes in human prehistory, like the spread of humans out of Africa (Cavalli-Sforza et al. 1993) and the expansion of Southwest Asian farmers into Europe (Menozzi et al. 1978). While this approach has some theoretical grounding in population genetics and remains popular, it can be misleading. Descriptive patterns are not always a good proxy for complex prehistoric population events; this relationship can be noisy because of the inherent randomness of inheritance and it can sometimes be counterintuitive (e.g., François et al. 2010; Novembre and Stephens 2008).

A model is an explicit and simplified representation of the processes that gave rise to observed data. In the context of population history or individual ancestry inference, model-based inference takes a range of hypothesized population histories (models) and computes (usually through computer simulations) the probability of the observed genetic data under each model. The basic principle here is that the strength of support for a model is proportional to the probability of the observed data under that model. Model-based inference uses probability theory both to compare models and to evaluate the uncertainties in parameter estimates within a model. The main problem with this approach is that it can be challenging to implement because of the large number of possible models and the complexity of the calculations. Mathematical and computational tools for model-based inference have recently made great advances, so that it has become practical for many problems that were until recently only amenable to simpler inferential approaches such as descriptive statistics methods. Model-based inference was used in the recent identification of the remains of Richard III (King et al. 2014) and is well-suited to genetic genealogy studies (Reid 2016).

Interpretative phylogeographic analysis was, until recently, the approach most widely used to infer the geographic origins of mtDNA and Y-chr lineages. It proceeds by first estimating the structure of the phylogenetic tree (genealogy) relating different mtDNA and Y-chr types. The estimated ages and geographic distributions of branches on that tree are then used to infer where and when they originated. Like descriptive statistics, phylogeographic analysis is vulnerable to the noisy and counterintuitive relationship between observed genetic patterns and the demographic history processes that generated them (Edmonds et al. 2004; Klopstein et al. 2006). However, unlike most descriptive statistics, interpretative phylogeographic analysis is usually not systematic (i.e., codified so that it can be performed by a computer, or replicated by another researcher). This allows inferences to be steered by subjective biases. The only known phylogeographic inference methodology that has been made systematic (Nested Clade Phylogeographic Analysis) (Templeton et al. 1995) has been shown to perform poorly (Nielsen and Beaumont 2009; Panchal and Beaumont 2007).

Some genetic ancestry testing companies have embellished the findings in the early scientific literature or information on the present-day distributions of haplogroups in their own databases to make spectacular claims with little justification, such as asserting that a customer is descended from a romanticised ancient population, or even a famous historical individual. This practice encourages individuals and groups to mould interpretations around pre-existing—often implicit—notions of ethnicity, nationality and ‘race’ (Jobling et al. 2016; Panofsky and Donovan 2017; Scully et al. 2013;

[Scully et al. 2016](#)). Advances in ancient DNA analysis have now provided empirical evidence that migration has been ubiquitous throughout human history and that modern populations are a poor proxy for past populations ([Pickrell and Reich 2014](#)). Consequently, the number of new papers employing interpretative phylogeography has declined.

2.2. BritainsDNA Company History

BritainsDNA was one of many brand names used by the Moffat Partnership, a business based in Melrose, Scotland, that offered genetic ancestry tests to the public between November 2011 and July 2017. The company launched a number of different websites, all selling the same tests but targeting markets in different areas of Britain and Ireland. ScotlandsDNA was launched in November 2011 ([Moffat 2011a](#)). BritainsDNA, IrelandsDNA and YorkshiresDNA were created in April and May 2012 ([Ahlstrom 2012](#); [Petroni 2014](#); [Southern Reporter editorial staff 2012](#)). An IzzardsDNA website went live in April 2014 to capitalise on the broadcast of a BBC TV programme called *Meet the Izzards* (see below). CymruDNAWales was launched in September 2014 to coincide with the broadcast of *DNA Cymru*, a five-part series of programmes on the Welsh-language channel S4C (see below). The Moffat Partnership was acquired by Source BioScience in December 2015 ([Source BioScience 2015](#)). The original websites continued to operate until the domain names expired and a new umbrella website, myDNA.Global, was established. In March 2016, the Moffat Partnership changed its name to Source BioScience Scotland. MyDNA.Global ceased trading on 3 July 2017 ([Lamb 2017](#)). The myDNA.Global website remained online until 31 August 2018. For consistency, we will use the name BritainsDNA throughout this article to refer to all the different genetic ancestry companies operating under the banner of the Moffat Partnership (see Appendix A for full website listings).

BritainsDNA was founded by Alistair Moffat and Jim Wilson ([Southern Reporter editorial staff 2013](#)). Records at Companies House show that they were appointed as directors of the Moffat Partnership in December 2012 and Wilson was appointed as the company's Chief Scientific Officer. The company's annual return in December 2012 showed that Wilson was the largest shareholder with 245 shares. Alistair Moffat and Lindsay Moffat had 170 shares each. The other shareholders and directors were Gianpiero Cavalleri, Catherine Hamilton, Francis Hamilton, Sarah Mathieson and Adam Moffat. Non-shareholding directors were Angelika Kritz-Wilson and Alan Mathieson ([Companies House 2012](#)).

Alistair Moffat was previously the Director of Programmes at Scottish Television, the Director of the Edinburgh Book Festival and the Founder of the Borders Book Festival. He is also the author of a number of non-fiction historical books published by Birlinn. He describes himself as a writer and historian on his website but he has not held an academic position as a historical researcher ([Moffat 2018](#)). Moffat was elected as Rector of the University of St Andrews in October 2011 ([BBC reporter 2011](#)). His three-year term as Rector overlapped with BritainsDNA's first three years of trading. Throughout the period of BritainsDNA's existence Jim Wilson held a position at the University of Edinburgh. He had previously founded the genetic ancestry testing company EthnoAncestry in 2004. Ethnoancestry was absorbed into ScotlandsDNA along with its customer database. Prior to the launch of ScotlandsDNA, Moffat and Wilson collaborated on a book entitled *The Scots: A Genetic Journey* ([Beauchamp 2011](#)) and on a six-part radio series of the same name broadcast on BBC Radio Scotland. The testing for the book and the programme was done through EthnoAncestry ([Vickers 2011](#)). When ScotlandsDNA first launched, customers were provided with a free copy of the book.

2.3. BritainsDNA's Tests

EthnoAncestry specialised in Y-chr testing, offering a range of à la carte SNP and STR tests for advanced genetic genealogists who were interested in refining their placement on the Y-chr phylogenetic tree. Customers were provided with their raw DNA results but without any interpretation. With the launch of ScotlandsDNA the company switched to a single test with a narrative report covering the fatherline and motherline for males and the motherline for females. The test originally

included around 200 Y chr SNPs and 200 mtDNA SNPs and later expanded to include nearly 400 of each. The fee was £170 for an mtDNA test for a female and £200 for a combined Y-chr and mtDNA test for a male. Customers received a haplogroup distribution map, a list of the SNPs defining their group and a three-page narrative history about their haplogroup. The haplogroups were given imaginative nicknames such as Berber, Ancient Egyptian, Norse Viking or Ancient Irish and the story told about each haplogroup was typically poorly referenced and generic in nature. Here is an extract from a report seen by the authors:

“ . . . your YDNA marker is HUNTER-GATHERER and your earliest ancestors reached Britain some time between 4000BC and 3000BC.

Your Y chromosome group, which tracks your paternal lineage, is R1b-M269. It is very common in Western Europe and also has outliers as far east as the Uigher peoples of Western China and in India and Russia.

Your Hunter-Gatherer ancestors crossed from Europe to Britain after the end of the last ice age but long before that they had undertaken a much more hazardous journey from Africa across the Red Sea into the Middle East. From there people fanned out east into Asia and Australasia and west into Europe . . .

When the development of farming began to spread, R1b-M269 multiplied and moved into every corner of Europe. By c3000BC it had certainly reached Britain and Ireland. And what directly caused populations to expand rapidly was the invention of porridge”.

In fact, everyone’s pre-farmer ancestors were hunter-gatherers. Everyone’s ‘earliest ancestors’ were primarily still in Africa, over 200,000 years ago. It is not possible to make any specific geographical claims about ancestors 3000BC–4000BC from Y-chromosome DNA (Y-DNA) alone. The modern-day distribution of R1b-M269 cannot be used as a proxy for the location of that single Y-DNA ancestor at any moment in the past. The migratory stories in the 3rd and 4th paragraph are generic archaeological hypotheses that are not specific to R1b-M269. Finally, there is no evidence that the invention of porridge was directly responsible for the rapid expansion of populations.

In February 2013 BritainsDNA launched a redhead test examining three common variants in the melanocortin 1 receptor (*MC1R*) gene which affect the ratio of the reddish pigment pheomelanin to the dark pigment eumelanin. The test was sold for £25 and was available as an add-on for existing customers (Downes 2013).

In June 2013 BritainsDNA launched the Chromo2 test, which covered approximately 15,000 Y-SNPs and 3000 mtDNA SNPs. Customers were given a genetic signature report, haplogroup distribution maps, a phylogenetic tree and a short haplogroup description based on the haplogroup nickname (Kennett 2013a). The lengthy narrative reports provided with the first test were dropped. The Chromo2 test for males cost £189. The female version (without the Y-SNPs) cost £170. A Chromo2 Raw Y-chr test was also offered for £129, providing a genetic signature report but no interpretation.

A biogeographical ancestry DNA test known as ‘All My Ancestry’ was later added. This test was based on an analysis of 300,000 SNPs scattered across the autosomes—the 22 pairs of recombining chromosomes which are not involved in sex determination. All My Ancestry was available as a standalone test for £169. By January 2014 the company had introduced a new Chromo2 Complete test, costing £250 for males and including the All My Ancestry, Y-chr, mtDNA and redhead reports. Females paid £220 and received All My Ancestry, mtDNA and redhead reports (Kennett 2013b, Petrone 2014). A blue eyes test costing £49 was introduced in August 2014 and a baldness test was launched in February 2015 (BritainsDNA 2014; BritainsDNA 2015a; Gibbons 2014). Eye colour is a complex trait and the test only covered one variant which is not completely predictive though the report did provide information on the percentages of people with the variant who have different-coloured eyes. We have not had access to a report for the baldness test. The separate Y-chr and mtDNA tests were later dropped

and customers were offered the Chromo2 Complete at the reduced price of £190 for males and £160 for females.

The BritainsDNA tests and reports were focused on customers' deep ancestry. The company did not have a matching database which meant that the tests had little application for genetic genealogy. However, prior to the advent of affordable next generation Y-chr sequencing, the Chromo2 test served as a useful high-resolution phylogeny test for advanced genetic genealogists. Some of the Y-SNPs included on the Chromo2 test were highly correlated with specific surnames and could be used to complement tests done elsewhere within surname and haplogroup projects. Although there is no reason to question the accuracy of the genetic data provided by BritainsDNA, their interpretation of these data was criticised, particularly the haplogroup stories (Chivers 2016).

3. Our Interactions with BritainsDNA

On 9 July 2012 Alistair Moffat was interviewed by Jim Naughtie on BBC Radio 4's *Today* programme about the findings of his "BritainsDNA project". During the interview Moffat made a number of unjustifiable claims, such as that the Bible was "beginning to come alive" through DNA testing, that he had identified an individual living in Scotland who is "Eve's grandson" and that he had found nine people descended from the Queen of Sheba. Listeners were directed to the BritainsDNA website and told that "You have to pay for it but we subsidise it massively", thus giving listeners the false impression that this was a publicly-funded academic research project.

Two of the scientists involved with the venture, Jim Wilson (University of Edinburgh) and Gianpiero Cavalleri (Royal College of Physicians in Ireland), had previously been based at University College London (UCL). As former colleagues, David Balding (DJB) and Mark Thomas (MGT) emailed them to express their dismay at what they had heard. They asked for clarification of the claim that BritainsDNA was "massively" subsidised and suggested that Moffat should be encouraged to retract his erroneous statements. The emails were copied to academic colleagues Francois Balloux (UCL) and Mike Weale (then at Kings College London and formerly at UCL), who were interested in the issues and knew some of those involved.

No response was received from their former colleagues but on 22 July 2012 MGT and DJB received an email from Professor Malcolm Grant, then UCL Provost, saying that Moffat had contacted him threatening to sue and asking the Provost to intervene. Moffat had demanded an apology and an undertaking that DJB and MGT retract their remarks and never repeat them. Professor Grant responded to Moffat saying that he had no intention of intervening, reminding him of the principles of academic freedom and pointing out that Moffat held office (Rector) at the University of St Andrews where those principles are as fully respected as they are at UCL. He suggested that Moffat engage in rational debate rather than try to suppress his critics.

MGT and DJB wrote to Moffat on 7 August 2012 explaining the many errors in his interview. Having received no response, a second email was sent on 28 August. Wilson and Cavalleri were copied in on both emails. There was no response from Moffat but Wilson replied by email two days later. He responded to the scientific issues raised by MGT and DJB but not the "we subsidise it massively" claim. MGT and DJB replied to Wilson the same day, offering to respond to his points but first requesting an explanation of Moffat's subsidy claim. A further follow up e-mail asking for clarification on the subsidy issue was sent on 3 September. That same day David McKie, a partner in Levy & McRae solicitors, representing both BritainsDNA and Moffat, emailed MGT and DJB (with a paper copy following in the post). The letter demanded three undertakings from MGT and DJB, warning of legal action if the demands were not met. These were:

1. That any statement, written or otherwise, which you make in relation to our client's organisation will not suggest that their work, or the statements and opinions of Mr Moffat, are in any way fraudulent, dishonest or disingenuous.
2. That you will not report or state as a matter of undisputed fact that our clients' science is 'wrong' or untrue. Clearly you disagree with their approach but the basis of that disagreement is a matter

of interpretation. Our clients accept that change and reinterpretation are part of the nature of scientific enquiry. But the issues of which you complain are currently issues of opinion and not matters of absolute fact, correct or incorrect.

3. That you will not report anything inaccurate or misleading in relation to the funding of our client's business, when you have no basis or knowledge of how the business was started or has been funded historically.

MGT and DGB had an extensive private discussion with Wilson at a meeting in London in November 2012 but he did not provide a substantive response. Cavalleri later resigned as a director of BritainsDNA (effective April 2013).

On 17 December 2012 Vincent Plagnol, a UCL colleague of DJB and MGT, posted on the *Genomes Unzipped* blog about the BBC Radio 4 *Today* programme interview and the lack of a scientific basis for the claims made (Plagnol 2012). Another UCL colleague, David Colquhoun, wrote about the affair but with a focus on the threat of legal action and the disguised advertising on the BBC (Colquhoun 2012). The article on *Genomes Unzipped* provoked a response from Wilson who was given the opportunity to write a guest post (Wilson 2013), which did finally clarify the subsidy issue:

“The remark in the interview about a subsidy . . . The sentiment was that many people were working for free to get the effort off the ground and had made investments from our own funds. There is no further subsidy”.

In February 2013 MGT, DJB and Debbie Kennett (DAK) attended the *Who Do You Think You Are? Live* exhibition at Olympia, London. Moffat gave a lecture that included misleading claims (Kennett 2013c). Unusually, there was no opportunity for questions from the audience at the end of the lecture. DAK tried to question Moffat afterwards to enquire when the “research” presented in the lecture was to be published but did not receive an adequate response. MGT tried to engage Moffat in debate but to no avail.

There have been no further direct interactions between us and BritainsDNA, Moffat or Wilson. Despite ignoring the solicitor's demands, no further legal action was taken, suggesting the letter was intended only to stifle debate. We have set up a website to document the saga; it includes a timeline and all documents of correspondence because of its public interest (Appendix A).

4. The Role of the Universities

In December 2012 MGT and DJB emailed a letter of complaint about Moffat's professional conduct in his role as Rector of the University of St Andrews to Professor Louise Richardson, then Principal and Vice-chancellor of St Andrews, now Vice-Chancellor at the University of Oxford. Thanks to the publicity on the *Genomes Unzipped* blog the matter was brought to the attention of Simon Singh, the prominent campaigner for libel reform. Singh was himself a victim of a damaging libel action, dropped only after two years, arising from his criticism of questionable claims by chiropractors (Singh 2010; Singh 2011). Singh had been awarded an honorary degree by the University of St Andrews and he was disappointed to read that its Rector was threatening legal action to stifle criticisms from academics. He wrote personally to Professor Richardson to encourage her to ensure that the university took the complaint seriously. At this point it was discovered that the Principal had not received the original e-mail. This was rectified and St Andrews then investigated the complaint. They set up a Senate investigation panel, which concluded that parts of the solicitor's letter sent on behalf of Moffat to MGT and DJB were “contrary to the principles of academic freedom and honest scientific debate in a matter of public interest”. This conclusion was endorsed by the Senate Business Committee and later by the Academic Council. Moffat was asked to “delineate more clearly between the university and his personal business interests”.

We later became aware that similar threats of legal action had been made to Jonathon Bucks, news editor of the St Andrews student newspaper *The Saint*. Bucks was “repeatedly warned” by Moffat that “if necessary, he would take legal action over anything the student newspaper published”

(Nature editorial 2013). Bucks ignored the warnings and the newspaper published several critical articles (Bucks 2013a, 2013b; Davies 2013). Moffat had previously unsuccessfully brought a £25,000 libel case against the Scottish Media group in 1999, claiming that he had been defamed by a satirical article in the *West Highland Free Press* (HeraldScotland Editorial Staff 1999).

Moffat's three-year tenure as Rector of St Andrews ended in October 2014. He was not nominated for an honorary degree, becoming only the second rector in the university's history not to receive that honour and the first not to be nominated (Bucks 2014). *The Saint* commented that Moffat "finishes his term with many positive changes" but with "a slightly tarnished reputation" as a result of the "BritainsDNA scandal" (Harsanyi 2014).

To our knowledge the University of Edinburgh took no action over Wilson's role in threatening legal action against academic colleagues nor over his media appearances as a representative of the university while not mentioning his commercial interest, which appeared to be more relevant to the claims that he made. Wilson was subsequently promoted to Professor by the University of Edinburgh.

5. The Role of the Media

BritainsDNA was notable for its prominent coverage in the UK media. Moffat's previous position at Scottish Television, and his involvement with the Edinburgh Festival Fringe and the Borders Book Festival, had brought him into contact with many celebrities and journalists, particularly in Scotland. He was able to exploit these contacts to promote his company through considerable free publicity (O'Connor 2015).

A particularly concerning aspect of BritainsDNA's marketing was that the commercial nature of the venture was frequently disguised. People were encouraged to take a DNA test to participate in "research" as part of a "project". The two principal shareholders of BritainsDNA held positions at Scottish universities. Although their university positions were not connected with their work at BritainsDNA, these associations were mentioned in marketing material to add credibility. The BritainsDNA website included a page on research and development which stated that they were "open to collaborations from academic partners" and "committed to publishing relevant research in the academic peer-reviewed literature". However, no peer-reviewed research paper was ever published by the company. Instead, the "research" was published in press releases and in newspapers to generate further publicity for the company. Often these press releases coincided with the launch of a new test or a new feature. Celebrities were encouraged to have their DNA tested and their results were shared in newspapers and on the radio. Prior relationships and conflicts of interest were not declared. It remains unclear if the celebrities understood that they were being used for promotional purposes or if they genuinely thought they were contributing to a scientific research project.

The disguising of a commercial venture as a research project and the exaggerated nature of the claims served to undermine legitimate scientific research on human population history and evolution. There was a danger that the public would become disillusioned with the science and lose their trust in scientists. As Jobling et al. commented: "The presentation of nonsense in the guise of science is not only misleading the paying customer but runs the risk of damaging science itself" (Jobling et al. 2016).

5.1. Newspaper, Broadcast and Online Coverage

In this section, we quantify the scale of UK TV, radio and print media coverage of BritainsDNA. In order to highlight the scientific and ethical issues raised, we detail some specific cases. BritainsDNA is not the only company selling genetic ancestry tests in the UK, nor the only company to make misleading inferences from haplogroups. Phillips identified 74 companies offering ancestry testing (Phillips 2016). However, the misleading claims made by other companies are generally confined to their own websites and not disseminated through mainstream media outlets.

A search was conducted on 13 August 2017 of the following UK online newspaper websites: the BBC website, *Daily Mail Online*, *The Guardian* and *The Observer*, *The Independent*, *The Scotsman*, *The Times* and *The Sunday Times*, *WalesOnline* and the Scottish newspaper *The Courier* and using

the following search terms: “BritainsDNA”, “ScotlandsDNA”, “IrelandsDNA”, “YorkshiresDNA”, “CymruDNAWales”, “Moffat AND DNA”. A list of articles is provided in Supplementary Materials File S1.

The first direct promotions of the company were published in *The Scotsman* on 30 November 2011 to coincide with the launch of the new ScotlandsDNA website (Moffat 2011a, 2011b). Readers were encouraged to participate in a “ground-breaking plan to test the DNA of thousands of Scots” led by “author and historian” Alistair Moffat (Moffat 2011a). It was not clarified that this project was a commercial venture rather than a scientific research project. Moffat’s position as Rector at the University of St Andrews was listed in his biography at the bottom of the article but there was no mention of his financial interest in ScotlandsDNA. An additional feature article by Moffat was published in the print edition of *The Scotsman* (Moffat 2011c). The article included a reader offer with the headline “Are you a Pict or a Viking?” Readers were invited to have their DNA tested as part of a “new national project”. They were told that “With new technology we have brought the costs down to £170 for women and £200 for men”. To get involved in the project readers were directed to the ScotlandsDNA website. A five-part series in *The Scotsman* by Moffat, beginning in October 2015, was also accompanied by a reader’s offer for a discounted ScotlandsDNA test.

The ScotlandsDNA website carried a banner until late 2013 with the legend “In proud association with *The Scotsman* and *The Courier*”. *The Scotsman* published 33 articles promoting the company or Moffat’s books whereas *The Courier* only published a single article. Ten of *The Scotsman* articles were written by Moffat. Six articles, although not bylined, appear to have been sourced from the Moffat and Wilson book *The Scots: A Genetic Journey* (Moffat and Wilson 2011). There is no public information on the status of the relationship between *The Scotsman* and ScotlandsDNA. Clearly the newspaper was happy to provide the company with free publicity but it is not known if they also took a percentage of sales through reader offers, or if Moffat received a payment for the articles he wrote for the paper and for the serialisation of his book. Whatever the case may be, the extensive use of advertorials for a commercial venture undermines the editorial integrity of the newspaper.

Another tactic used by BritainsDNA was the use of celebrities to endorse their tests. Robin McKie, the Science Editor of *The Observer*, was tested by BritainsDNA and he returned the favour by writing an article to promote the launch of the new BritainsDNA website (McKie 2012). The focus of his article was the “remarkable claim” that the actor Tom Conti is related to Napoleon Bonaparte:

“According to Moffat, Conti’s DNA marker reveals his male lineage is Saracen in origin. His ancestors settled in Italy around the 10th century before one of them, Giovanni Buonaparte, settled in Corsica and founded the family branch that produced Napoleon . . . He [Conti] is clearly a close relative of Napoleon. Only DNA could have told that story”.

The “marker” in question is M34, a SNP that defines a sub-branch of Y-haplogroup E (International Society of Genetic Genealogy ISOGG). A scientific paper has indeed been published purporting to show that Napoleon’s Y-chromosome belongs to the E-M34 lineage (Lucotte et al. 2011). The authors determined the haplogroup by testing some beard hairs stored in a reliquary at the Bertrand Museum of Châteauroux, which were thought to belong to Napoleon. They suggested that the most recent common ancestor (MRCA) of all modern bearers of E-M34 lived around 7000 years ago (\pm 850 years). Different methods of calculating the time to the MRCA using SNPs instead of STRs would have yielded different dates (Balanovsky 2017). Given the small fraction of ancestry that the Y-chr represents, these results—if correct and regardless of the date—provide no evidence of a closer relationship between Conti and Napoleon than between a randomly picked European and Napoleon. They merely share a Y-chr lineage in common with perhaps millions of other men. Saracen is the nickname that BritainsDNA give to the E-M34 haplogroup but these names have no scientific basis and we cannot tell where E-M34 originated.

The media coverage of the launch of BritainsDNA continued the practice of disguising a commercial venture as an academic research project. In addition to the account in *The Observer*,

the story was covered by *The Telegraph*, the *Daily Mail*, *The Scotsman* and the BBC Scotland website (BBC Editorial Staff 2012; Cooper 2012; Cramb 2012; McGinty 2012). None of the reports clarified that the project was a commercial venture. Only the *Daily Mail* and *The Telegraph* mentioned that it was necessary to spend £170 to buy a DNA test to participate in the “project”. All five reports described BritainsDNA as a project that was set up by Dr Jim Wilson, a geneticist based at the University of Edinburgh and Alistair Moffat, a historian and the then Rector of the University of St Andrews but not their roles in a commercial genetic ancestry company. Evidently, none of the journalists verified the status of the project with the universities in question or sought opinions from scientists working in relevant fields.

In June 2013, *The Times* exclusively covered a story from BritainsDNA about Prince William’s Indian ancestry (Brown 2013a, 2013b, 2013c), which was subsequently widely shared in other newspapers and picked up by TV and radio stations worldwide. DNA tests were carried out on two of William’s matrilineal relatives who are likely to share his mtDNA sequence. Their genealogy traced back to a common female-line ancestor, Eliza Kewark, who had lived in western India but was “usually described as Armenian”. The analysis was carried out by Jim Wilson who was described as “a genetics expert at the University of Edinburgh and BritainsDNA”. He concluded that the results provided “unassailable” evidence of William’s Indian heritage (Brown 2013c). However, *The Times* articles left many questions unanswered, such as how the researchers had eliminated the possibility that the rare mtDNA haplotype was not also present in Armenia (Kennett 2013d). The research was not published in a scientific or genealogical journal so it is not possible to scrutinise the findings. The only additional information about the research was provided in a press release on the BritainsDNA website. Although not mentioned in the media coverage, the Prince William story coincided with the launch of BritainsDNA’s new Chromo2 test.

The story took up most of the front page of *The Times* and almost two further pages inside. There was also a special offer for *Times* readers who were encouraged to visit the BritainsDNA website to “discover more about the unknown stories in their genes”. *Times* subscribers were offered a “free upgrade package worth £65” if they ordered a test through the company. Media observers criticised *The Times* for the disproportionate coverage of a trivial story and the link with a readers’ offer. Greenslade pointed out that the story “didn’t exactly cut it as a splash in the paper of record, as many of the reader comments below the online version make clear” (Greenslade 2013). Johnson commented: “From where I’m standing, it looks like one of Britain’s most famous news outlets has traded the sacred space on its front page for a spurious science story that is really intended to puff itself and a marketing partner” (Johnson 2013). Some observers also raised questions about the ethics of inferring Prince William’s mtDNA signature by proxy and publishing it without his consent (Hern 2013; Middleton 2013; PHG Editorial Staff 2013).

These are just a few examples of the type of stories generated in the press by BritainsDNA. The eight newspapers and websites we studied published a total of 109 articles about BritainsDNA between 2011 and 2016. Following the acquisition of the Moffat Partnership by Source BioScience, the company’s tests were no longer actively promoted and only one incidental story was published in 2016. Just six articles provided critical content about the company. The remaining 103 articles promoted the company. None questioned the information provided in the company’s press releases or included an uninvolved expert for commentary. Only one of the 103 promotional articles was written by a science editor.

5.2. Analysis of the Press Coverage

The following analyses focus on the relationship between BritainsDNA and the press. Fig 1 below illustrates the strong relationship between the UK and the world ($R^2 = 0.86$) when considering public interest in DNA ancestry testing, using the search terms ‘DNA’ and ‘ancestry.’ Data were obtained using Google trends, between 1 January 2011 and 13 August 2017 and plotted at a monthly resolution. Meanwhile the press coverage of BritainsDNA (using 109 articles listed in Supplementary Materials

File S1) bears no resemblance to the UK public interest in this industry ($R^2 = 0.09$). We analyse the proportion of articles that mention BritainsDNA in this period in the online versions of three respected UK newspapers (*The Telegraph*, *The Independent* and *The Guardian*) and compare this with the two hypothesised promotional vehicles (*The Scotsman* and *WalesOnline*). A Google search was conducted within each newspaper's online domain for articles between 1 January 2011 and 13 August 2017 with 'DNA' in the title. The total count was recorded, as was the count of those articles that mention BritainsDNA (or other company alias) and any other DNA ancestry testing companies in the article content. Results are shown in Table 1 and Figure 1 below:

Table 1. The tally of articles mentioning BritainsDNA and other DNA ancestry companies in the searched domains.

Searched Domain	Online Newspaper	Number of DNA Articles	Number Mentioning BritainsDNA	Number Mentioning any other DNA Ancestry Company
www.telegraph.co.uk	<i>The Telegraph</i>	241	3	4
www.independent.co.uk	<i>The Independent</i>	146	0	2
www.theguardian.com	<i>The Guardian</i>	269	3	12
www.scotsman.com	<i>The Scotsman</i>	24	13	1
www.walesonline.co.uk	<i>WalesOnline</i>	20	11	1

Breakdown of other DNA ancestry companies: AncestryDNA = 7, 23andMe = 9, Ancestry = 1, MyHeritage = 1, Living DNA = 1, BioClinics = 1.

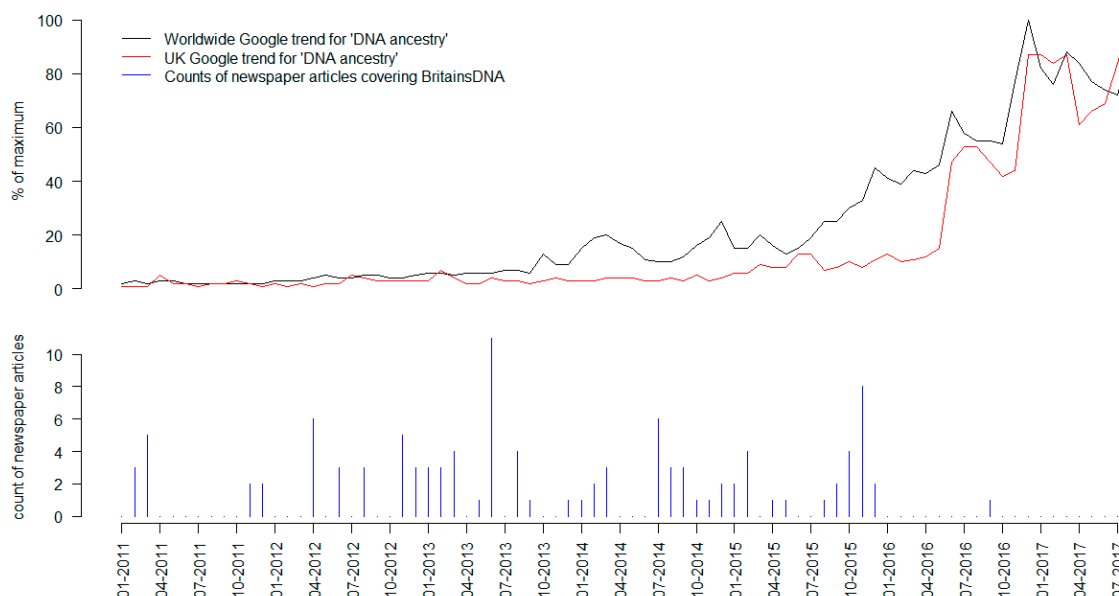


Figure 1. Google trends show a strong correlation between the global and UK increasing interest in 'DNA ancestry' since c.2013. However, the growing interest in this new industry does not explain the newspaper coverage of BritainsDNA.

Overall the proportion of broadsheet DNA articles that mention BritainsDNA is 0.9%. In contrast, the proportion is 54.2% and 55.0% for *The Scotsman* and *WalesOnline* respectively. Statistically, these differences are highly significant ($p = 7.1 \times 10^{-21}$ for *The Scotsman* and $p = 5.8 \times 10^{-18}$ for *WalesOnline*).

The abundant coverage of BritainsDNA in *The Scotsman* and *WalesOnline* might be explained by the hypothesis that both these papers have an unusually large interest in the field of DNA ancestry. To assess this hypothesis, we perform a similar analysis on the number of articles that mention other DNA ancestry companies. We estimate the expected background rate from the proportion of DNA ancestry articles in the broadsheets (excluding BritainsDNA articles) as 28 in 656 = 2.7%, which is not

significantly different from the 2 in 44 = 4.5% of DNA articles mentioning a different DNA ancestry company in *The Scotsman* and *WalesOnline* combined.

Overall these results suggest that, although *The Scotsman* and *WalesOnline* had a similar level of interest in the general field of DNA ancestry as the broadsheet newspapers, both were used as promotional vehicles for BritainsDNA.

5.3. TV and Radio Coverage

A list of TV and radio programmes featuring BritainsDNA-related content is provided in Supplementary Materials File S2. This list was compiled by monitoring the social media accounts of BritainsDNA and ScotlandsDNA on Twitter and Facebook.

The first programme identified in this list is a six-part radio series *The Scots: A Genetic Journey*, broadcast in February/March 2011 on BBC Radio Scotland. The programme was presented by Alistair Moffat and Jim Wilson and was timed to coincide with the publication of their book of the same name (Moffat and Wilson 2011). At the time of broadcast, Wilson's genetic ancestry testing company EthnoAncestry was still operating independently, prior to its merger with ScotlandsDNA in November 2011. The EthnoAncestry website, as preserved in the Internet Archive, shows that the company featured the programme on their home page, presumably to give legitimacy to their DNA tests. It has not been possible to review the content of this series as it was only brought to our attention a long time after it was broadcast and it is no longer available online. However, the programmes were reviewed in a series of blog posts by Amanda E Epperson (Epperson 2011a, 2011b, 2011c, 2011d) indicating that some of the content of the programme was questionable. For example, she comments: "It turns out the McAuleys, from MacOlaf, have a DNA marker that clearly links them with southwest Ireland, suggesting they were perhaps brought to northern Scotland as slaves by the Vikings". It would appear that no independent experts appeared on the programme to query such claims.

Moffat appeared on BBC radio 15 times between 2011 and 2014 (Table 2). The guest appearances followed a similar pattern. He was invited onto the programmes to discuss the latest "research" from BritainsDNA such as the launch of a new project or a new DNA test. Often the presenter had his DNA tested with BritainsDNA and the results were presented on the programme. Although Moffat has no background in genetics and is not an academic historian, his claims were accepted on these programmes without question and there was no opportunity for academic geneticists and historians to challenge his stories. We are not aware of any other genetic ancestry testing companies being given a similar opportunity to promote their tests so extensively on the BBC.

Table 2. Appearances on UK radio by Alistair Moffat.

Date	Radio Station	Programme
2 March 2011	BBC Radio 4	<i>Today</i> programme with James Naughtie
1 June 2011	BBC Radio 4	<i>Today</i> programme with James Naughtie
7 November 2011	BBC Radio Scotland	Tom Morton
8 December 2011	BBC Radio Scotland	<i>MacAulay and Co</i>
1 March 2012	BBC Radio Scotland	<i>MacAulay and Co</i>
17 April 2012	BBC Radio Scotland	<i>MacAulay and Co</i>
9 July 2012	BBC Radio 4	<i>Today</i> programme with James Naughtie
11 July 2012	BBC Radio Scotland	Tom Morton
30 August 2012	BBC Radio 2	Jeremy Vine
26 September 2012	BBC Radio Scotland	Tom Morton
7 November 2012	BBC Radio Scotland	Tom Morton
8 November 2012	BBC Three Counties Radio	Roberto Perrone
9 November 2012	BBC Radio Scotland	<i>Call Kaye</i>
25 March 2013	BBC Radio Scotland	<i>John Beattie Programme</i>
6 March 2014	BBC local radio	<i>Mark Forrest Show</i>

Moffat was interviewed by James Naughtie three times on the BBC's flagship *Today* programme. In all these interviews, he was given the opportunity to promote his business and his questionable claims passed without challenge. Moffat had known Naughtie for many years, dating back to when Naughtie worked for *The Scotsman* (Moffat 2011b). Naughtie has also worked with Moffat in his capacity as patron of the Borders Book Festival and as a trustee of the Great Tapestry of Scotland (Borders Book Festival 2018; Scottish Tapestry 2018). He wrote the introduction for Moffat's book *Britain's Last Frontier* (Moffat 2012). The two men appeared together in promotions for this book, at book festivals and similar events. Naughtie featured in a YouTube video endorsing Moffat's candidature for Rector at the University of St Andrews. Naughtie did not declare the personal connection in the radio programmes. Although it was legitimate for Naughtie to invite a friend to talk about a potentially interesting subject, it was a mistake to do so without involving any science experts to challenge the claims (Colquhoun 2012).

BritainsDNA was also able to generate publicity for its DNA tests through involvement in various programmes on public-service TV channels in the UK. A two-hour documentary called *Meet the Izzards*, featuring the comedian Eddie Izzard, was broadcast on BBC One in peak viewing hours in February 2013. The programme focused on Eddie Izzard's maternal and paternal ancestry through Y-chr and mtDNA testing. BritainsDNA was not directly mentioned but the programme implicitly promoted the tests offered by the company and used many of its sales promotion phrases. The only genetics expert appearing on the programme was Jim Wilson, Chief Scientific Officer of BritainsDNA, who was therefore able to promote his business interests without fear of challenge from an independent expert. Wilson was introduced as being from the University of Edinburgh but his presence on the programmes seemed to have more to do with his BritainsDNA roles (Director, Chief Scientific Officer and shareholder) rather than his university position. Much content of the two programmes was scientifically questionable, for being generic (common to us all, not just Eddie Izzard), exaggerated, misleading, or wrong (Kennett 2014). Izzard was already known to Moffat as they had met at the Edinburgh Fringe Festival (Southern Reporter editorial staff 2013). It is not known if this prior friendship had any influence on the editorial decisions but BritainsDNA certainly benefitted from the friendship. After the first programme was aired Eddie Izzard tweeted to his then two million followers: "If you have watched #meettheizzards and you'd like to do something with your DNA, please go to <http://www.britainsdna.com>". He shared the same message on his Facebook page.

An episode of *The One Show* on BBC One in March 2013 featured a segment on genetic ancestry testing. The science presenter Michael Mosley promoted the haplogroup names used commercially by BritainsDNA. Audience members stood up with placards showing their Y or mtDNA types and a label like "hunter-gatherer" or "herdsman farmer" and told the camera, for example, "my father-line is Scandinavian" or "ancient Irish". Mosley was given his own DNA results and told that his haplogroup was "Germanic". Jim Wilson was once again the only geneticist to appear on the programme.

An episode of the *Hairy Bikers*, broadcast on BBC Two in October 2015, also featured testing by BritainsDNA. We did not have the opportunity to review this programme but the content is summarised in a post on the BritainsDNA Facebook page (BritainsDNA 2015b).

S4C, the public service Welsh-language TV channel, aired a five-part series entitled *DNA Cymru* in 2015 which overtly promoted BritainsDNA. Ian Jones, the CEO of S4C, was an old friend of Alistair Moffat's—they had previously worked together at Scottish Television Enterprises (Bevan 2014). A website was set up to accompany the TV series. This page has undergone a number of changes since it was first published but on the earliest version preserved in the Internet Archive on 10 April 2015 the following description was given:

The S4C series *DNA Cymru* will set out to answer the questions by using DNA samples from the people of Wales today. The series is part of an exciting project *Cymru DNA Wales* set up in a partnership between S4C, *CymruDNAWales*, Trinity Mirror—publishers of the *Western Mail* and the *Daily Post*—and production company Green Bay Media.

The website explained that “The CymruDNAWales venture is the brainchild of S4C Chief Executive, Ian Jones who went on to discuss the idea with the successful Scottish research company responsible for ScotlandsDNA”. To participate in the research, it was necessary to “purchase a test kit from the science experts in this project, The Moffat Partnership Limited”. At the bottom of the page there was a link to the DNACymruWales website.

The introductory programme in the *DNA Cymru* series *Who are the Welsh?* was broadcast on 1 March 2015 (St David’s Day). The first half of the programme was devoted to a retelling of the human story. In the second half, three Welsh celebrities, Sian Lloyd, the TV weather forecaster, Dafydd Iwan, the former president of Plaid Cymru and Gareth Edwards, the rugby player, were given their DNA results from CymruDNAWales. They were all told stories of questionable scientific merit about the origins of their Y-chr and mtDNA haplogroups (Kennett 2015a). The Welsh political blogger Jac o’ the North described it as a “crude, money-making exercise dressed as ‘science’” (Jac o’ the North 2015).

The final four programmes in the series were broadcast on S4C in November and December 2015. The producers had clearly listened to the complaints and had made some attempts to address the issues raised. The claims made were not so fanciful and there was some real science featured from independent and credible scientists like Professor Dan Bradley of Trinity College Dublin and Professor Peter Donnelly from the University of Oxford. It is not known if the academics who participated in the programme were aware of the commercial nature of the venture or that their science was going to be mixed up with speculative findings from the unpublished research of BritainsDNA (Kennett 2015b, 2015c; Lamb 2015). Jim Wilson was the principal scientist for the *DNA Cymru* series. He featured prominently but none of the many scientists who are critical of his interpretation of haplogroups were invited onto the programme to present the scientific consensus.

6. Countering the Bad Science

DJB and MGT independently submitted complaints to the BBC about Alistair Moffat’s interview on the *Today* programme. The BBC responded that it was normal to interview “commercial firms about their products” but failed to acknowledge the point that the commercial aspect was not declared and was disguised as an academic “project”. They justified the interview on the grounds that the story had been covered in *The Telegraph* and that it was “interesting”. DJB sent multiple follow up e-mails and the complaint was eventually investigated by the BBC’s Editorial Complaints Unit. DJB was advised in February 2014 that his complaint had been upheld on grounds of both accuracy and product prominence and a statement was published on the BBC website (BBC Editorial Complaints Unit 2014; BBC Help and Feedback 2014).

DJB and DAK also complained to the BBC about the *Meet the Izzards* programme. The BBC responded that “the production team met an extensive range of independent, academic experts” but it was not explained why Jim Wilson, BritainsDNA’s Chief Scientific Officer, was the only scientist who appeared on the programme and in the credits. The BBC also wrongly claimed that “the series reflected the standard, accepted interpretations”. They asserted that “No viewer could have been informed by watching the series that Dr Wilson had any relationship with a testing company”. Yet it was the failure to make viewers aware of this conflict of interest that was one of the main concerns, as well as the fact that the content of programme was motivated by Wilson’s commercial interests with BritainsDNA and had little bearing on his academic research at the University of Edinburgh.

DAK submitted further complaints to the BBC about the BritainsDNA segment on *The One Show* and Moffat’s appearances on the *John Beattie Programme* on BBC Radio Scotland and the *Mark Forrest Show* on BBC Local Radio. The responses for the most part did not adequately deal with the points raised, though Husain Husaini, the executive producer of the *Mark Forrest Show* did concede that “the science behind DNA testing is more complex and the results less certain” than the interview suggested and “we fully accept therefore that the programme should have provided more accurate coverage of the issue”. DAK enquired about the editorial decision to invite Moffat onto the *Mark Forrest Show* to discuss Viking DNA rather than a suitably qualified scientific expert. She was told

by Paul Moseley, Senior Complaints Adviser, that Moffat was selected because “A member of the team heard an interview with him on BBC Radio York last year. They felt that he was an engaging speaker on the subject of DNA and noted that he might be an interesting guest for the programme”. The complaint about the *Mark Forrest Show* was escalated to the BBC’s Editorial Complaints Unit in an attempt to question the editorial decision to choose a guest not for their scientific expertise but for their ability to talk in an “engaging” way. DAK also wanted to address the issue of Alistair Moffat’s repeated appearances across the BBC. She was told by Richard Hutt, the Complaints Director, that:

“ . . . the choice of guests is a matter of editorial discretion and does not fall within the remit of the ECU. In practice that means I can consider whether what was said during the broadcast met the BBC’s editorial standards but not whether the programme ought to have invited him [Alistair Moffat] to participate.

You have also raised the issue of Mr Moffat’s appearances across the BBC over a number of years. Again, this falls outside our remit—we are limited to considering specific items broadcast or published by the BBC and are not able to investigate claims of editorial breaches over time and across output”.

Therefore, while the BBC provides a website where viewers and listeners can comment on individual programmes within 30 days of broadcast, surprisingly there is no mechanism for airing concerns about long-term editorial bias and the use of unqualified individuals to talk as if they had science expertise.

Our full correspondence with the BBC has been published on our website (Appendix A).

Once the news about the threats of legal action and the criticisms of BritainsDNA went public on the *Genomes Unzipped* blog, the tide slowly began to turn. MGT was given the opportunity to write an article in the Notes & Theories section of *The Guardian* criticising the misleading claims made by some genetic ancestry testing companies and BritainsDNA in particular (Thomas 2013). Martin Richards (University of Huddersfield) and Vincent Macaulay (University of Glasgow) wrote a follow up article in defence of the *Meet the Izzards* programme and in particular the use of interpretative phylogeography (Richards and Macaulay 2013). However, Richards and Macaulay are in a small minority of population geneticists who still use this technique to make inferences about the deep ancestry of populations from the Y-chr and mtDNA of living people. Interestingly, Richards had previously criticised the deep ancestry inferences made by genetic ancestry testing companies in an earlier *Guardian* article (Richards 2003). He had also previously co-authored an article which was critical of the “distorting effects of commercialization” which are “omnipresent in science and are often reflected in misguided research goals, further exacerbated by the misrepresentation of research and false claims made by scientists and reporters alike” (Bandelt et al. 2008).

MGT and DJB were invited by the charity Sense About Science to work on a publication to set the record straight about genetic ancestry testing. They worked in collaboration with academic colleagues Dr Turi King (now Professor), Dr Lounès Chikhi, Dr Rosalind Harding, Professor Mark Jobling and Professor Guido Barbujani. *Sense About Genetic Ancestry Testing* was published in March 2013 (Sense About Science 2013) generating some press coverage (Collins 2013; Ghosh 2013; Macrae 2013; Rowley 2013), much of it positive but some felt that the whole genetic ancestry industry was being tarred with the same brush. DAK was invited by Sense about Science to blog on their website clarifying this point and correcting some inaccurate media coverage of the guide (Kennett 2013e).

The BBC began to make amends for its previously poor coverage of genetic ancestry testing. The Science Unit made a programme on *The Business of Genetic Ancestry* broadcast on Radio 4 in May 2015. The programme was introduced by the science writer Dr Adam Rutherford and provided a balanced overview of what you can and cannot learn from a genetic ancestry test. MGT and DAK were interviewed along with Professor Mark Jobling from the University of Leicester.

There was very limited critical coverage of BritainsDNA in the UK press. *The Sunday Times* covered James Naughtie’s interview with Alistair Moffat on the *Today* programme and the ensuing

threats of legal action (Gillespie 2012). A blog post about the affair was published on Occam's Corner, the *Guardian's* science blog (Cule 2013). *The Sunday Times* was the only newspaper to report that the substance of DJB's complaint about the *Today* interview had finally been upheld by the BBC (Gillespie 2014).

The launch of our debunking website (Appendix A) in March 2014 received a brief mention in the *Times Higher Education Supplement* (THE editorial staff 2014). The BBC's Welsh-language website published one critical article about the S4C *DNA Cymru* series (BBC Cymru Fyw editorial staff 2015). Tom Chivers, a science writer for the UK edition of *Buzzfeed*, published a critical story in December 2016, by which time the company had been sold to Source BioScience (Chivers 2016).

The only publication to regularly provide critical coverage of BritainsDNA was *Private Eye*. It described how "Fleet Street's finest have swallowed another piece of scientific hokum from self-styled 'genetics expert' Alistair Moffat" with the publication of the story about Prince William's DNA (Private Eye Reporter 2013a). It pointed out that "the BBC has given BritainsDNA its biggest airing over the past year, including radio and TV interviews, news items, features or programmes unquestioningly promoting the company's assertions" (Private Eye Reporter 2013b). It reported on the upholding of the complaint about the interview on the *Today* programme (Private Eye Reporter 2014). The *DNA Cymru* programme on S4C was criticised as "another commercial undertaking dressed as proper collaborative science" and it was suggested that Moffat had "again used his old boys' network, just as he did at the BBC. Ian Jones, chief executive of S4C happens to be a mate" (Private Eye Reporter 2015a). When the BBC aired *The Business of Genetic Ancestry* on Radio 4 *Private Eye* informed its readers that "Moffat, for once shy of media exposure, declined to appear on the programme" (Private Eye Reporter 2015b).

Adrian Timpson (AJT) has presented the issues discussed here to several academic audiences, including the UCL 2016 CoMPLEX 'The Misrepresentation of Science' Conference and the UCL 2016 LMCB 'Ethics in Science' conference. MGT has presented the issues discussed here at a Wenner-Gren Senaste symposium in Stockholm, titled 'The Age of Humans in Europe'.

7. Conclusions

This case study has shown how a direct-to-consumer genetic ancestry testing company benefitted from a disproportionate amount of media coverage in the UK. It highlights the ease with which someone with high-profile media contacts was able to manipulate the media to promote his commercial interests disguised as a science "project". There was a failure to question dubious press releases and programme ideas, or get feedback from experts working in the field before publishing an article or going ahead with a programme. BritainsDNA was provided with multiple opportunities to promote bad science on the BBC and other major media outlets without challenge. The underlying principles of the BBC's impartiality guidelines to ensure 'due weight to the many and diverse areas of an argument' (BBC Editorial Guidelines. n.d. n.d.) were not followed.

Academics and broadcasters need to ensure that they separate their academic roles from their commercial interests and make any conflicts of interest (even if only perceived) clear. Universities have a duty to ensure that their staff do not misuse their academic positions to advance their personal and financial interests.

Threats of legal action can have a pernicious impact on academic freedom. DJB and MGT consulted UCL lawyers shortly after receiving the threat of legal action; their advice was to concede and make no further public comments about Moffat's or BritainsDNA's activities. This guidance was in stark contrast to the UCL Provost's principled response to Moffat's threat. DJB and MGT ignored the legal advice and they ultimately achieved a positive outcome, at some personal risk. It is important for those who can speak out to do so, not just to deal with a particular issue but for the longer-term health of their field. BritainsDNA's misuse of legal process created a side story which itself became newsworthy. This is an example of the Streisand effect (Jansen and Martin 2015): an attempt to censor critics had the unintended consequence of raising awareness of the issue.

The poor behaviour of BritainsDNA risked damage to the public perception of the fields of genetic history and genetic genealogy. The public were given a false idea of what they can learn from a genetic test and the media failed to provide balance by writing about the legitimate uses of DNA testing for genealogy. When the media did finally start to criticise genetic ancestry testing companies (e.g., the coverage of the Sense About Science booklet) they sometimes went overboard the other way giving people the mistaken impression that all DNA tests were useless. Fortunately, the eventual demise of BritainsDNA suggests that bad science did not pay in the long term in this case.

We believe this detailed case study is a rare example in the literature of how science can be distorted for commercial gain by influential, well connected figures in society. The case demonstrates the necessity but also the risks of critically engaging with developments of this kind. We hope that it will be of interest to historians and sociologists of science, that educators, practitioners and researchers in science communication will learn from our experience and that this case study can be used to inform training and education programmes. Most importantly, we hope that other scientists will be encouraged by our experience and will not be afraid to engage with the media to challenge misreporting.

Supplementary Materials: The following are available online at <http://www.mdpi.com/2313-5778/2/4/47/s1>.

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Abbreviations

AJT	Adrian Timpson
DAK	Debbie Kennett
DJB	David Balding
MGT	Mark Thomas
MC1R	melanocortin 1 receptor
MRCA	most recent common ancestor
mtDNA	mitochondrial DNA
SNP	single nucleotide polymorphism
STR	short tandem repeat
UCL	University College London
Y-chr	Y-chromosome
Y-DNA	Y-chromosome DNA

Appendix A. Websites

The UCL Debunking Genetic Astrology website contains a full account of the BritainsDNA saga including a detailed timeline with copies of all the original correspondence: <https://www.ucl.ac.uk/mace-lab/genetic-ancestry>

The various websites formerly operated by the Moffat Partnership are preserved in the Internet Archive:

https://web.archive.org/web/*/www.britainsdna.com
https://web.archive.org/web/*/www.cymrudnawales.com
https://web.archive.org/web/*/www.irelandsdna.com
https://web.archive.org/web/*/www.izzardsdna.com
https://web.archive.org/web/*/https://www.mydna.global
https://web.archive.org/web/*/www.scotlandsdna.com
https://web.archive.org/web/*/www.yorkshiresdna.com

<https://www.facebook.com/britainsdna> BritainsDNA Facebook page

<https://twitter.com/ScotlandsDNA> ScotlandsDNA on Twitter

There was previously a ScotlandsDNA page on Facebook and a BritainsDNA account on Twitter but both accounts have now been deleted.

<https://web.archive.org/web/20170706123932/http://ethnoancestry.com>

The EthnoAncestry website in the Internet Archive

http://www.geocities.ws/dnalogy1/EA/Old/about_us.htm An undated public version of the Ethnoancestry website

https://isogg.org/wiki/BritainsDNA_haplogroup_nicknames List of haplogroup nicknames used by BritainsDNA

<http://www.alistairmoffat.co.uk> Alistair Moffat's personal website

<https://www.birlinn.co.uk/Alistair-Moffat> Alistair Moffat's profile on his publisher's website

[http://www.research.ed.ac.uk/portal/en/persons/jim-wilson\(653f83c2-60ca-4d34-a1b3-b7ba1f7ef86c\).html](http://www.research.ed.ac.uk/portal/en/persons/jim-wilson(653f83c2-60ca-4d34-a1b3-b7ba1f7ef86c).html)

Jim Wilson's profile on the University of Edinburgh's website

https://youtu.be/_1mID06KTCM James Naughtie declaring support for Alistair Moffat as rector

https://www.s4c.cymru/cymrudnawales/e_index.shtml The website for the S4C DNA Cymru series

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